What is claimed is:

1. A recursive discrete Fourier transformation method wherein data values x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1), x(t+N) sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, a frequency component, which is degree k (k is 0 or a positive integer smaller than N) obtained by carrying out complex Fourier transformation on the data stream, is obtained such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1) supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using data value x(t+N) supplied at time t+N, data value x(t) stored in the first memory means temporarily and the complex Fourier coefficients $X_r(k, t)$, $X_i(k,t)$ stored in the second memory means temporarily, obtaining complex Fourier coefficients $X_r(k, t+1)$ and $X_i(k, t+1)$ to the data stream supplied since time t+1 with respect to a positive constant value A for giving an amplitude value corresponding to a difference between the x(t+N) and the x(t) according to a following equation:

$$X_r(k,t+1) = \left\{X_r(k,t) + \frac{1}{A}\left[x(t+N) - x(t)\right]\right\} \times \cos\left[2\frac{\pi k}{N}\right] + X_i(k,t)\sin\left[2\frac{\pi k}{N}\right]$$

$$X_i(k,t+1) = X_i(k,t)\cos\left[2\frac{\pi k}{N}\right] - \left\{X_r(k,t) + \frac{1}{A}\left[x(t+N) - x(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

2. A recursive discrete Fourier transformation method according to claim 1 wherein inverse discrete Fourier transformation data subjected to inverse discrete Fourier transformation using a positive constant **a** is supplied so as to obtain a complex Fourier transformation coefficient to the supplied inverse discrete Fourier transformation data,

the discrete Fourier transformation being carried out using the positive constant A corresponding to the positive constant **a**.

3. A recursive discrete Fourier transformation method according to claim 1 wherein **k** indicating a degree of the complex Fourier coefficient is set to a desired value and Fourier transformation to the set value **k** is repeated at every time having an equal interval.

4. A recursive discrete Fourier transformation method wherein with sampling frequency as fs, data values x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1), x(t+N) sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, a frequency interval given with a minimum frequency f1 and a maximum frequency f2 to the data stream is regarded as a measuring frequency interval, a frequency interval obtained by dividing that measuring frequency interval by the N is assumed to be an analysis frequency interval and a result of the frequency analysis obtained by carrying out complex Fourier transformation at every analysis frequency interval is obtained as a frequency component which is k (k is 0 or a positive integer smaller than N) times the frequency interval, such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream x(t), x(t+1),

x(t+2), x(t+3), ..., x(t+N-1) supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using data value x(t+N) supplied at time t+N, data value x(t) stored in the first memory means temporarily and the complex Fourier coefficients $X_r(k, t)$, $X_i(k,t)$ stored in the second memory means temporarily, obtaining complex Fourier coefficients $X_r(k, t+1)$ and $X_i(k, t+1)$ within the frequency interval with the minimum frequency f1 and the maximum frequency f2 to the data stream supplied since time t+1 with respect to a positive constant A for giving an amplitude corresponding to a difference between the x(t+N) and the x(t) according to following equations:

$$X_r(k,t+1) = \left\{X_r(k,t) + \frac{1}{A}\left[x(t+N) - x(t)\right]\right\} \times \cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$+ X_i(k,t)\sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$X_i(k,t+1) = X_i(k,t) \times \cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\} - \left\{X_r(k,t) + \frac{1}{A}\left[x(t+N) - x(t)\right]\right\}$$

$$\times \sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

5. A recursive discrete Fourier transformation method according to claim 4 wherein inverse discrete Fourier transformation data subjected to inverse discrete Fourier transformation using a positive constant **a** is supplied so as

to obtain a complex Fourier transformation coefficient to the supplied inverse discrete Fourier transformation data,

the discrete Fourier transformation being carried out using the positive constant A corresponding to the positive constant **a**.

6. A recursive discrete Fourier transformation method according to claim 4 wherein **k** indicating a degree of the complex Fourier coefficient is set to a desired value and Fourier transformation to the set value **k** is repeated at every time having an equal interval.

7. A recursive discrete Fourier transformation method wherein data values x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1), x(t+N) sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, a frequency component, which is degree k (k is 0 or a positive integer smaller than N) obtained by carrying out complex Fourier transformation on the data stream, is obtained such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1) supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the complex Fourier coefficients $X_r(k, t) - jX_i(k, t)$ stored in the second memory means temporarily, obtaining complex Fourier coefficients $X_r(k, t+1) - jX_i(k, t+1)$ to the data stream supplied since

time t+1 based on a transfer function expressed in a following equation.

$$H(z)=A\left(1-z^{-N}\right)\left\{\frac{\cos\left[2\frac{\pi k}{N}\right]-j\sin\left[2\frac{\pi k}{N}\right]-z^{-1}}{1-2\cos\left[2\frac{\pi k}{N}\right]z^{-1}+z^{-2}}\right\}$$

where A is a positive constant for providing [x(t+N) - x(t)] with an amplitude.

8. A recursive discrete Fourier transformation method according to claim 7 wherein the positive constant value A for providing with an amplitude corresponding to a difference between the x(t+N) and the x(t) is capable of being set selectively with an inverse number of square root of 1, N or 1/N.

9. A recursive discrete Fourier transformation method according to claim 7 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the Fourier transformation to the set value **k** is repeated at every time having an equal interval.

10. A recursive discrete Fourier transformation method wherein with sampling frequency as fs, data values x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1), x(t+N) sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, a frequency interval given with a minimum frequency f1 and a maximum frequency f2 to the data stream is regarded as a measuring frequency interval, a frequency interval obtained by dividing that measuring frequency interval by the N is assumed to be an analysis frequency interval and a result of the frequency analysis provided by carrying out complex Fourier transformation at every analysis frequency interval is

obtained as a frequency component which is k (k is 0 or a positive integer smaller than N) times the frequency interval, such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream x(t), x(t+1), x(t+2), x(t+3), ..., x(t+N-1) supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t+1) - jX_i(k, t+1)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t+1) - jX_i(k, t+1)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the complex Fourier coefficient $X_r(k, t) - jX_i(k, t)$ stored in the second memory means temporarily, obtaining complex Fourier coefficients $X_r(k, t+1) - jX_i(k, t+1)$ at the frequency interval given by the minimum frequency f1 and the maximum frequency f2 to the data stream supplied since time t+1 based on a transfer function expressed in a following equation:

$$H(z) = A\left(1 - z^{-N}\right)\left\{\frac{\cos[2\pi p] - j\sin[2\pi p] - z^{-1}}{1 - 2\cos[2\pi p]z^{-1} + z^{-2}}\right\}$$

where A is a positive constant for providing [x(t+N) - x(t)] with an amplitude value, and

$$p = \frac{1}{fs}\left\{\frac{(f2 - f1)k}{N-1} + f1\right\}, \qquad 0 \le k \le N-1$$

11. A recursive discrete Fourier transformation method according to claim 10 wherein the positive constant value A for providing with an amplitude corresponding to a difference between the x(t+N) and the x(t) is capable of being set selectively with an inverse number of square root of 1, N or 1/N.

12. A recursive discrete Fourier transformation method according to claim 10 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the Fourier transformation to the set value **k** is repeated at every time having an equal interval.

13. A recursive discrete Fourier transformation method for obtaining complex Fourier coefficients, wherein data values $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, a frequency component, which is degree k (k is 0 or a positive integer smaller than N) obtained by carrying out complex Fourier transformation on the data stream, is obtained such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$ supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the data value $x_r(t+N) + jx_i(t+N)$ supplied at time t+N, the data value $x_r(t) + jx_i(t)$ stored in the first memory means temporarily and the complex Fourier coefficient $X_r(k, t)$ and $X_i(k, t)$ stored in the second memory means temporarily and used recursively, obtaining complex Fourier coefficients $X_r(k, t+1)$ and $X_i(k, t+1)$ to the data

stream supplied since time t+1 with respect to a positive constant A for giving an amplitude value corresponding to the difference between the $x_r(t+N)$ and the $x_r(t)$ according to a following equation:

$$X_r(k,t+1)=\left\{X_r(k,t)+\frac{1}{A}\left[x_r(t+N)-x_r(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$-\left\{X_i(k,t)+\frac{1}{A}\left[x_i(t+N)-x_i(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

$$X_i(k,t+1)=\left\{X_i(k,t)+\frac{1}{A}\left[x_i(t+N)-x_i(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$+\left\{X_r(k,t)+\frac{1}{A}\left[x_r(t+N)-x_r(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

14. A recursive discrete Fourier transformation method according to claim 13 wherein by using data value $y_r(t) + jy_i(t)$ supplied at time t, data value $y_r(t+N) + jy_i(t+N)$ supplied at time t+N and complex inverse discrete Fourier coefficients $Y_r(k, t)$ and $Y_i(k, t)$ with the real part and the imaginary part obtained with respect to N data values $y_r(t) + jy_i(t)$, $y_r(t+1) + jy_i(t+1)$, . . ., $y_r(t+N-1) + jy_i(t+N-1)$ supplied from time t to time t+N-1,

a real part $Y_r(k, t+1)$ and an imaginary part $Y_i(k, t+1)$ of each complex inverse discrete Fourier coefficient of N data values supplied since time t+1 are obtained with respect to a positive constant value B for giving an amplitude corresponding to a difference between the $y_r(t+N)$ and the $y_r(t)$ as inverse discrete Fourier transformation data, according to following equations,

$$Y_r(k,t+1)=\left\{Y_r(k,t)+\frac{1}{B}\left[y_r(t+N)-y_r(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$+\left\{Y_i(k,t)+\frac{1}{B}\left[y_i(t+N)-y_i(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

$$Y_i(k,t+1)=\left\{Y_i(k,t)+\frac{1}{B}\left[y_i(t+N)-y_i(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$-\left\{Y_r(k,t)+\frac{1}{B}\left[y_r(t+N)-y_r(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

and after the obtained inverse discrete Fourier transformation data is supplied, discrete Fourier transformation on the supplied inverse discrete Fourier transformation data is carried out,

the recursive discrete Fourier transformation conducting discrete Fourier transformation by using the positive constant value A corresponding to the positive constant value B.

15. A recursive discrete Fourier transformation method according to claim 13 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the Fourier transformation to the set value **k** is repeated at every time having an equal interval.

16. A recursive discrete Fourier transformation method for obtaining complex Fourier coefficients, wherein with sampling frequency as fs, data values $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N complex data values supplied since time t as a data stream, a frequency interval given with a minimum frequency f1 and a maximum frequency f2 to the data stream is regarded as a specified frequency interval, a frequency interval obtained by dividing the specified frequency interval by the N is assumed to be a minimum frequency interval and

a result of the Fourier transformation provided by carrying out complex Fourier transformation at every minimum frequency interval is obtained as a frequency component which is k (k is 0 or a positive integer smaller than N) times the minimum frequency interval, such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are complex Fourier coefficients, the method comprising:

a first step of storing the data stream $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the data value $x_r(t+N) + jx_i(t+N)$ supplied at time t+N, the data value $x_r(t) + jx_i(t)$ stored temporarily in the first memory means and complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ stored temporarily in the second memory means and used recursively, obtaining complex Fourier coefficient $X_r(k, t+1)$ and $X_i(k, t+1)$ in the specified frequency interval given by the minimum frequency f1 and the maximum frequency f2 to the data stream supplied since time t+1 with respect to a positive constant A for giving an amplitude value corresponding to a difference between the x(t+N) and the x(t) according to a following equation:

$$X_r(k,t+1) = \left\{X_r(k,t) + \frac{1}{A}\left[x_r(t+N) - x_r(t)\right]\right\} \times \cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$-\left\{X_i(k,t) + \frac{1}{A}\left[x_i(t+N) - x_i(t)\right]\right\} \times \sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$X_i(k,t+1) = \left\{X_i(k,t) + \frac{1}{A}\left[x_i(t+N) - x_i(t)\right]\right\} \times \cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$+\left\{X_r(k,t)+\frac{1}{A}\left[x_r(t+N)-x_r(t)\right]\right\}\times\sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1}+f1\right]\right\}$$

17. A recursive discrete Fourier transformation method according to claim 16 wherein by using data value $y_r(t) + jy_i(t)$ supplied at time t, data value $y_r(t+N) + jy_i(t+N)$ supplied at time t+N and complex inverse discrete Fourier coefficients $Y_r(k, t)$ and $Y_i(k, t)$ with the real part and the imaginary part obtained with respect to N data values $y_r(t) + jy_i(t)$, $y_r(t+1) + jy_i(t+1)$, ..., $y_r(t+N-1) + jy_i(t+N-1)$ supplied from time t to time t+N-1,

a real part $Y_r(k, t+1)$ and an imaginary part $Y_i(k, t+1)$ of each complex inverse discrete Fourier coefficient of N data values supplied since time t+1 are obtained with respect to a positive constant value B for giving an amplitude corresponding to a difference between the $y_r(t+N)$ and the $y_r(t)$ as inverse discrete Fourier transformation data, according to following equations,

$$Y_r(k,t+1)=\left\{Y_r(k,t)+\frac{1}{B}\left[y_r(t+N)-y_r(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$+\left\{Y_i(k,t)+\frac{1}{B}\left[y_i(t+N)-y_i(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

$$Y_i(k,t+1)=\left\{Y_i(k,t)+\frac{1}{B}\left[y_i(t+N)-y_i(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$-\left\{Y_r(k,t)+\frac{1}{B}\left[y_r(t+N)-y_r(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

and after the obtained inverse discrete Fourier transformation data is supplied, discrete Fourier transformation on the supplied inverse discrete Fourier transformation data is carried out,

the recursive discrete Fourier transformation

conducting discrete Fourier transformation by using the positive constant value A corresponding to the positive constant value B.

18. A recursive discrete Fourier transformation method according to claim 16 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the Fourier transformation to the set value **k** is repeated at every time having an equal interval.

19. A recursive inverse discrete Fourier transformation method for obtaining complex inverse Fourier coefficients wherein complex data values $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied since time t as a data stream, an inverse complex Fourier transformation component, which is degree k (k is 0 or a positive integer smaller than N) obtained by carrying out inverse complex Fourier transformation on the data stream, is obtained such that a real part $X_r(k, t)$ thereof and an imaginary part $X_i(k, t)$ thereof are inverse complex Fourier coefficients, the method comprising:

a first step of storing the data stream $x_r(t)+jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$ supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the inverse complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the inverse complex Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the data value $x_r(t+N) + jx_i(t+N)$ supplied at time t+N, the data value $x_r(t) + jx_i(t)$ stored

in the first memory means temporarily and the inverse complex Fourier coefficient $X_r(k, t)$ and $X_i(k, t)$ stored in the second memory means temporarily, obtaining inverse complex Fourier coefficients $X_r(k, t+1)$ and $X_i(k, t+1)$ to the data stream supplied since time t+1 with respect to a positive constant B for giving an amplitude value corresponding to the difference between the $x_r(t+N)$ and the $x_r(t)$ according to a following equation:

$$X_r(k,t+1) = \left\{X_r(k,t) + \frac{1}{B}\left[x_r(t+N) - x_r(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$+\left\{X_i(k,t) + \frac{1}{B}\left[x_i(t+N) - x_i(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

$$X_i(k,t+1) = \left\{X_i(k,t) + \frac{1}{B}\left[x_i(t+N) - x_i(t)\right]\right\}\cos\left[2\frac{\pi k}{N}\right]$$

$$-\left\{X_r(k,t) + \frac{1}{B}\left[x_r(t+N) - x_r(t)\right]\right\}\sin\left[2\frac{\pi k}{N}\right]$$

20. A recursive inverse discrete Fourier transformation method according to claim 19 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the inverse Fourier transformation to the set value **k** is repeated at every time having an equal interval.

21. A recursive inverse discrete Fourier transformation method for obtaining complex inverse Fourier coefficients wherein with sampling frequency as fs, data values $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ sampled at times t, t+1, t+2, t+3, ..., t+N-1, t+N (N is a positive integer which is 1 or more) each having an equal interval are supplied and with such N data values supplied

since time t as a data stream, a frequency interval given with a minimum frequency f1 and a maximum frequency f2 to the data stream is regarded as a specified frequency interval, a frequency interval obtained by dividing that specified frequency interval by the N is assumed to be a minimum frequency interval and a result of the inverse Fourier transformation provided by carrying out inverse complex Fourier transformation at every minimum frequency interval is obtained as a frequency component which is k (k is 0 or a positive integer smaller than N) times the minimum frequency interval, in the form of a real part $X_r(k, t)$ and an imaginary part $X_i(k, t)$, the method comprising:

a first step of storing the data stream $x_r(t) + jx_i(t)$, $x_r(t+1) + jx_i(t+1)$, $x_r(t+2) + jx_i(t+2)$, $x_r(t+3) + jx_i(t+3)$, ..., $x_r(t+N-1) + jx_i(t+N-1)$, $x_r(t+N) + jx_i(t+N)$ supplied since time t at time t+N-1 into a first memory means temporarily;

a second step of obtaining the inverse Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ of the data stream stored temporarily at the first step;

a third step of storing the inverse Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ obtained at the second step into the second memory means temporarily; and

a fourth step of by using the data value $x_r(t+N) + jx_i(t+N)$ supplied at time t+N, the data value $x_r(t) + jx_i(t)$ stored temporarily in the first memory means and preceding inverse Fourier coefficients $X_r(k, t)$ and $X_i(k, t)$ stored temporarily in the second memory means, obtaining inverse Fourier coefficient $X_r(k, t+1)$ and $X_i(k, t+1)$ in the specified frequency interval given by the minimum frequency f1 and the maximum frequency f2 to the data stream supplied since time t+1 with respect to a positive constant B for giving an amplitude value corresponding to a difference between the x(t+N) and the x(t) according to following equations:

$$X_r(k,t+1) = \left\{X_r(k,t) + \frac{1}{B}\left[x_r(t+N) - x_r(t)\right]\right\} \times \cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1} + f1\right]\right\}$$

$$+\left\{X_i(k,t)+\frac{1}{B}\left[x_i(t+N)-x_i(t)\right]\right\}\times\sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1}+f1\right]\right\}$$

$$X_i(k,t+1)=\left\{X_i(k,t)+\frac{1}{B}\left[x_i(t+N)-x_i(t)\right]\right\}\times\cos\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1}+f1\right]\right\}$$

$$-\left\{X_r(k,t)+\frac{1}{B}\left[x_r(t+N)-x_r(t)\right]\right\}\times\sin\left\{2\frac{\pi}{fs}\left[\frac{(f2-f1)k}{N-1}+f1\right]\right\}$$

22. A recursive inverse discrete Fourier transformation method according to claim 21 wherein **k** indicating the degree of the complex Fourier coefficient is set to a desired value and the inverse Fourier transformation to the set value **k** is repeated at every time having an equal interval.